

Measure: Time-of-Sale Residential Energy Efficiency Retrofits (G17)

Adopt a city ordinance that establishes a mandatory time-of-sale requirement that residential buildings being sold meet basic energy efficiency goals.

Emission reduction potential in 2020:	11,973 tCO ₂ e
Percentage of goal (2012):	0.5%
Percentage of goal (2020):	0.5%
Total annual average implementation costs 2011-2020:	\$13.49 million
Entity that bears the costs of implementation:	Home sellers/buyers (\$13.464 million) and City of Tucson (\$25,000)
Cost/Savings resulting from 2020 investments per tCO ₂ e over 20-year investment life (239,456 tCO ₂ e:	Savings of \$138 / tCO ₂ e
Net annual savings over 20-year investment life, investments made in 2020:	\$17 million
Entity that realizes the financial return:	Home sellers/buyers
Equitability (progressive/regressive, income/revenue neutral, etc):	Cost caps on such a program can be tailored to the price range of buildings being sold to avoid regressive effects.
Potential unintended consequences:	Diversion of investments to sub-optimal projects regarding GHG savings

Notes:

The measure's financial impacts are based on the following assumptions:

- Investments of \$2,000 per home resulting in 1650 kWh/yr. electricity savings.
- Measure is crafted to affect 6,000 homes/yr. through 2016, rising 500/yr. to 8,000/yr. by 2020.

During the implementation period 2012-2020:

- 59,000 homes would be affected by the program.
- Each home would save from \$3,419 to \$4,132 from the \$2,000 investment
- The \$118 million invested would have saved \$38.7 million by end of 2020 and \$226.2 million over the lifetime of the investments.

Background information:

One proven way municipalities can spur the installation of energy efficiency in existing homes is to require a minimum level of efficiency upgrades at the time of property transfer. One form this takes is an Energy Conservation Ordinance (ECO).

Such ordinances can apply at the time of sale of owner-occupied residential units, which this measure addresses. ECOs can also be applied to rental property landlords and a version of this is analyzed elsewhere in this report. Finally, an ECO can be designed to apply to the transfer of commercial properties as well, or be applied to major renovations as well as the time of sale of properties.

Funding for a residential ECO, or RECO, is typically provided by the seller and calculated as either a percentage of the sale price, a set spending cap per unit, or a per square foot rate. In addition, there may be a filing fee in the range of \$15 to \$50. Responsibility for implementation of the upgrades can be negotiated between the seller and buyer, with time allowed for the buyer to complete improvements after the time of sale.

The energy efficiency goals can be prescriptive, featuring a list of mandatory upgrades (low-flow shower heads, weatherstripping, water pipe insulation, duct seals, solar shades, etc.), generally with a not-to-exceed cost per building.

A second program design is the performance-based approach where a series of diagnostic tests are used to determine the quickest, least-cost retrofit measures that contribute to a prescribed energy efficiency goal for a building. Both approaches have been used successfully, most prominently in Berkeley, CA. This community has recently moved from a prescriptive to a performance-based model that is expected to deliver deeper efficiency gains over time.

There is a lack of information about the energy savings results for most current ECO programs because tracking the before and after energy use is not within the scope or budget of the ordinances. However, San Francisco reports an average energy efficiency increase of 15% from its RECO.¹

Business-as-Usual:

A mandatory time-of-sale ordinance achieves in a more aggressive fashion what might otherwise take much more time to realize – the capture of increased energy savings and the addition of home value that are two important co-benefits of such a measure. In addition, greenhouse gas emission reductions would occur more slowly in the residential building sector absent a time-of-sale ordinance and the energy efficiency gains it stimulates.

Description of Measure and Implementation Scenario:

A Residential Energy Conservation Ordinance (RECO) is proposed that should be designed to require a performance-based energy efficiency retrofit up to \$2,000 at the time of owner-occupied residential home resale.

We forecast that upon implementation of such an ordinance, it could conceivably apply in its first year to a minimum of 10,000 new and existing homes based on recent, historically-low reported monthly home sales in Tucson, averaged over a full year.²

However, to gain the most energy savings for the lowest price, and not to penalize those who have already achieved energy efficiency gains, we recommend excluding from this measure those homes that were built after 2000-2001 (timed to the effective date in Tucson of the International Energy Conservation Code updated that year). We also recommend excluding those homes built earlier than 2000 whose owners can demonstrate that energy efficient upgrades have already taken place.

All other homes offered for sale or undergoing substantial renovation would fall under the requirement for an energy performance-based retrofit designed specifically for Tucson homes and climate.

Finally, we recommend that this requirement have an expenditure cap of perhaps \$400/home for low-income owners/buyers/sellers or an outright exclusion from the program. We recommend a low-income definition consistent with other City housing programs, such as the Environmental Services Low-income Assistance Program, which in 2010 defined low-income as ~\$33,075 for a family of four.³

In sum, the homes not subject to the measure would be 1) new homes sold each year, 2) homes excluded by a seller-based low-income threshold, and 3) existing homes that have had energy efficiency upgrades made to them or were built to be energy-efficient.

We project this would lower the number of homes to which a time-of-sale requirement would apply to 6,000 homes in the initial year, rising to 8,000 in 2020 as the economy grows and the sales of existing homes increases beyond today's historically depressed levels.

The average spending cap, which can be scaled to the price of the home, and reflecting today's costs of energy efficiency upgrades, would be \$2,000 per home. Ideally this limit would be annually adjusted to reflect inflation or deflation of the typical Tucson-area projects stimulated by the RECO ordinance.

The proposed performance-based RECO will, by definition, include a requirement for a pre-sale home energy audit and a post-implementation energy audit so that energy and cost savings can be tracked and used in program modifications as necessary in later years.

Until actual program data are available, we assume an energy savings potential of 15%/home as has been realized in the San Francisco RECO, with its \$1,300 cap on investments required per home. Actual savings may well be higher if the cost cap selected in Tucson exceeds the \$1,300 number in the San Francisco program.

We project that the program could be designed and implemented by the beginning of 2012.

Has the Measure been implemented elsewhere and with what results?

Berkeley, CA has had a mandatory energy efficiency retrofit program in place since 1987.⁴ Its Residential Energy Conservation Ordinance (RECO) applies to all dwelling units: homes, residential areas of mixed-use buildings, tenants-in-common, condominiums, multi-family properties, live-work spaces and boarding houses (including the common areas/common systems) and must be complied with upon sale or transfer of property, or major renovation.

A general outline of upgrades required in the Berkeley program includes:

- 1) **Toilets** – 1.6 gal/flush, or flow reduction devices;
- 2) **Showerheads** – 3.0 gal/minute flow rate – available free from the utility district;
- 3) **Faucet Aerators** – 2.75 gal./minute flow rate for kitchens and bathrooms – available free from the utility district;
- 4) **Water Heater Blankets** – insulation wrap of R-12 value;
- 5) **Hot and Cold Water Piping** – Insulate the first two feet from the heater to R-3 value;
- 6) **Hot Water Piping in Pumped Re-circulating Heating Systems** – Insulate all pipes to R-3 value;
- 7) **Exterior Door Weatherstripping** – permanently affix weatherstripping and door sweeps or door shoes;
- 8) **Furnace Duct Work** – Seal duct joints and add insulation wrap to R-3 value;
- 9) **Fireplace Chimneys** – Must have dampers, doors or closures;
- 10) **Ceiling Insulation** – Insulate to R-30 value or greater; and
- 11) **Common Area Lighting (multi-unit buildings)** – Replace incandescent bulbs with compact fluorescent lamps (CFL) of at least 25 lumens.

There is a limit to the amount of money that homeowners must spend to meet upgrades under the Berkeley program. Homeowners need not spend more than: a) 0.75% of the final property sales price when a single structure of two housing units or less is sold; b) 0.75% of the final property sales price for each structure when a property with more than one structure of two housing units or less is sold; or c) \$0.50 per square foot when any one structure with three or more housing units is sold.

All homes or apartment buildings with a combined value of \$50,000 or more in renovations must demonstrate compliance with the energy efficiency regulations by being inspected by and filing a certificate of compliance with the City of Berkeley. Compliance is the responsibility of the building permit applicant, which in most cases is the property owner.

Since its inception, an estimated 10,000 residential units have been affected by Berkeley's RECO. The ordinance is reported to have played a role in a 14% reduction in residential natural gas use over the 2000 –2010 period.⁵

However, the City also reports that, "Because energy savings from RECO are not currently measured or verified, it is impossible to know exactly what role RECO is playing to save energy in our community."⁶ Moving to a performance-based, audit-driven RECO is intended to correct this problem.

Another time-of-sale energy efficiency retrofit program has been in place in **San Francisco CA** since 1982. Under this program, owners of residential property who wish to sell their property must obtain a valid energy inspection, install certain energy (since 1991) and water conservation devices or materials and then obtain a certificate of compliance.⁷

All of this must occur prior to transfer of title of any residential buildings as specified in the ordinance, and the seller must provide a copy of the compliance certificate to the buyer prior to title transfer.

The maximum amount to be spent depends upon when the decision is made to comply, as well as the number of units in a building. In the case of 1 or 2 family dwellings and individual condominiums and co-op units when complying as an entire building, the maximum expenditure is \$1,300.

In the case of buildings containing 3 units or more (including condominiums), the owner can choose to comply before selling a property and the maximum expenditure will be 1% of the assessed value of the building. If a seller chooses to comply as a result of a pending sale, the maximum expenditure will be 1% of the purchase price as stated in the real estate sales contract.

The \$1,300 limitation applies **ONLY** to 1 and 2 family dwellings and condominium and co-op units.

Energy/Emission analysis:

The latest statistics from the Tucson Association of Realtors Multiple Listing Service indicate a median sale price for Tucson homes in December 2010 of \$139,500.⁸ The average sale price during this period was \$186,399. There were 907 unit sales in December 2010, a 13% increase from November and a 2% increase from December 2009. Over the course of a year, this translates to approximately 11,000 home sales.

We assume that between 6,000 and 8,000 eligible homes (see proposed exclusions in the implementation scenario) will be sold in Tucson each year once program implementation is underway. We assume the number of eligible homes remains at 6,000/year from 2012 through 2016, then increases 500 per year to 8,000 in 2020.

Using the savings realized under San Francisco's RECO program, we project a similar 15% energy savings per year per residence. The average residential electricity usage in Tucson is reported by TEP to be 11,000 kWh/year. A 15% savings per RECO-affected home would result in an average reduction of 1,650 kWh/year.

Each year that 6,000 homes are brought under the ordinance at the above savings/home, overall energy savings would total $6,000 \times 1,650 \text{ kWh} = 9,900,000 \text{ kWh/yr}$. For the total of 8,000 participating homes in 2020, 13,200,000 kWh/yr. would be saved.

Greenhouse gas emission reductions realized in the year 2020 would amount to 11,972 tCO₂e. Total emissions saved during the 2012-2020 period equals: 8,980 tons/year 2012 – 2016, and 11,972 tons/year by 2020.

We assume the investments have a 20-year life.

Climate Change Impact Summary in tCO₂e:

COT 1990 Citywide GHG emissions (baseline):	5,461,020 tCO ₂ e
MCPA 7% reduction target for COT:	5,078,749
2012 BAU GHG emissions projection:	7,000,000
2020 BAU GHG emissions projection:	7,343,141
GHG emissions reduction to meet 7% goal (2012):	1,921,251
GHG emissions reduction to meet 7% goal (2020):	2,264,392
Contribution of this Measure in 2020:	11,973

Economic analysis:

Measure Costs

We assume that the investments caused by Tucson's RECO average the full \$2,000 average cap level. Electricity prices start at \$0.08/kWh in 2011 and increase 2.4%/yr.

The measure's costs to the projected 59,000 homeowners are shown in Table 1 below.

We also assume that the energy efficiency investments would not be made otherwise.

City of Tucson administration of the measure is estimated at 0.25 FTE/yr. at \$100,000 per FTE for 9 years = \$225,000.

Total investment: \$118 million + \$225,000 = \$118,225,000.

Measure Savings

The estimated electric bill savings stimulated by Tucson's RECO range from \$3,418 to \$4,132, reflecting the steadily increasing prices of electricity saved. For simplicity, we have assumed that all savings are electrical, but in reality some savings will be natural gas and water consumption savings.

Table 1: Financial Analysis

Year	\$ Invested (millions)	Yearly Savings (millions)*	\$ Saved Over 20-yr Life Per House
2012	\$12.00	\$ 0.41	\$3,418
2013	12.00	1.25	3,500
2014	12.00	2.13	3,584
2015	12.00	3.05	3,670
2016	12.00	4.01	3,758
2017	13.00	5.06	3,849
2018	14.00	6.23	3,941
2019	15.00	7.54	4,036
2020	16.00	8.99	4,132
2020 Total	\$118.00	\$38.67	\$226.2 million all houses**

* Assumes retrofitted homes average 6 months of savings in first year of retrofit

** Total savings of the 59,000 dwellings affected through 2020, during years 2012-2040

Net Economic Impact

The net economic impact over the 20-year lifetime of the RECO-stimulated investments in 59,000 dwellings:

Measure Costs:	\$118.225 million
Measure Savings:	\$226.200 million over lifetime of investments
Net Savings:	\$107.977 million

We use the 1.5 multiplier applied to energy cost savings by Tucson citizens to estimate the net positive impact on the City of Tucson economy of this measure as \$162 million from 2012-2040.

Co-benefits:

There are multiple co-benefits that accompany the immediate energy and cost savings that flow from energy efficiency retrofits to currently energy-inefficient residential homes in Tucson. These co-benefits include:

1. An increase in home comfort as cooling and heating systems deliver more of their intended benefits to the conditioned space.
2. Likely delay in utility need to build new power plants thus minimizing rate increases owing to new capacity additions.
3. Increased adaptive capacity to temperature extremes expected as long-term climate warms in the southwest.
4. An increase in property resale values as energy efficiency gets built into a home.

Equitability:

The RECO initiative should be designed with exceptions and cost limits to keep from imposing regressive requirements on transactions of homes among low-income populations or on those who have already made significant energy efficiency investments in their property since its construction or purchase.

Potential unintended consequences:

Energy efficiency upgrades are arguably the most difficult to research since they cover a host of potential measures rather than one discrete technology. A package of energy

efficiency upgrades for one home could be vastly different from those recommended for another home, so it is more difficult for property owners to compare quality of service with one another.

Since the recommended upgrades will vary widely with each property, there is no way to compare one's upgrades with those of peers. The only measurable evidence of the benefits of energy efficiency upgrades is in reduced utility bills, and this is not a comprehensive measure as many of the benefits fall within the realm of improved indoor air quality. Thus, there may be some unexpected skepticism over potential benefits along with unmet expectations if promised savings do not materialize.

Other potential unintended consequences include the potential that investments to meet the City's energy efficiency requirements are not the optimal investment for that home to reduce carbon emissions. Whether this occurs or not depends on how well the City's performance requirements are crafted regarding savings of GHGs.

Endnotes

¹ Residential Energy Conservation Ordinance Factsheet.
http://www.ecoleader.org/assets/downloads/RECO/RECO_factsheet.pdf.

² *Arizona Daily Star*. January 11, 2010. http://azstarnet.com/real-estate/article_0c10d5a1-6af1-5ff8-829f-ea12f40d415e.html.

³ City of Tucson Environmental Services, at:
<http://cms3.tucsonaz.gov/sites/default/files/esd/ES2010%20EformREVa.pdf>.

⁴ Berkeley Energy Commission. March 24, 2010. Item 4.
http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Commissions/Commission_for_Energy/ESD2010-03-24_CompletePacket.pdf.

⁵ Ibid.

⁶ Ibid.

⁷ The Residential Energy Conservation Ordinance. San Francisco, CA.
http://www.recaonline.com/docs/arc/arc2008/PointofSale_SanFranCA.pdf.

⁸ *Arizona Daily Star*. op.cit.